Received: 28 January 2020 | Revised: 15 November 2020 | Accepted: 16 December 2020

DOI: 10.1111/jfr3.12693

ORIGINAL ARTICLE

CIWEM Chartered Institution of Water and Environmental Management | Journal of Flood Risk Management | WILEY

Relationship between urban planning and flooding in Port Harcourt city, Nigeria; insights from planning professionals

Adaku Jane Echendu

School of Social Sciences, Western Sydney University, Sydney, Australia

Correspondence
Adaku Jane Echendu, School of Social Sciences, Western Sydney University, Sydney Australia.
Email: adakuchyoma@gmail.com

Abstract

Flooding is widely recognised as a global problem which has worsened in recent years due to climate change. In Nigeria, flooding remains the most widespread environmental disaster with the population of 200 million suffering numerous threats from perennial flooding. Port Harcourt in Southern Nigeria experiences annual flooding on a significant scale. While research has linked the flooding in Port Harcourt to poor urban planning, little research has engaged with planning professionals to investigate this relationship. This paper fills this gap. It explores how urban planning is linked to flooding in Port Harcourt and reports on qualitative research undertaken with five urban planners in Port Harcourt. The findings affirm that poor planning and/or lack of compliance with planning regulations are the main factors contributing to the flooding of Port Harcourt. The urban planners gave their expert opinions on how to control the flooding and unanimously agreed that improved planning practices could control the endemic flooding problem in the city. This implies that the government needs to work more closely with urban planners and other stakeholders to effectively control and find a lasting solution to the flooding problem in Port Harcourt city.

KEYWORDS

disaster management, flooding, Nigeria, pluvial flooding, urban planning, urban resilience, urbanisation

1 | BACKGROUND AND INTRODUCTION

Flooding is a serious disaster with destructive impacts on people and the environment (Doocy, Daniels, Murray, & Kirsch, 2013). It is the most widespread disaster globally with a host of multifaceted and interrelated factors causing flooding (Doocy et al., 2013). In Nigeria, unusually high rainfalls and a host of anthropogenic factors such as land use practices and inadequate drainage induce flooding (Israel, 2017; Ugonna Nkwunonwo, Whitworth, & Baily, 2016; Ologunorisa & Adeyemo, 2005). Despite the seriousness of the flooding problem in Nigeria, a lot remains unknown about the problem and the perspective of planners is unexplored in research. This knowledge gap is more evident when compared to the body of studies from other countries that also experience flooding like China, the United States, and the United Kingdom (UK) (Nkwunonwo, Malcolm, & Brian, 2015).

Poor urban planning is linked to flooding (Cirella & Iyalomhe, 2018; Dabi & Kporha, 2015). Urban planners are at the forefront of formulating and implementing planning policies and controls. However, little has been done to engage urban planning professionals themselves in research. This is important because their expertise and insight can help to better understand areas of failure and how to address them. More research on flooding and the influence of plans and planning in Nigeria would help to better understand and control this problem. This paper engages with planners in Port Harcourt on the flooding issue. The findings are presented across three sections: (a) effects of poor urban planning in Port Harcourt; (b) flooding and waste management in Port Harcourt; and (c) addressing the flooding: urban planners' perspectives.

2 | PLANNING AND FLOODING

Even though urban planning is integral to improving the environment which the relevant legislations recognise, numerous shortcomings too often exist in planning systems and practices. Urban floods have become a worldwide phenomenon but management practices differ among countries and vary in relation to existing technologies, infrastructure, and urban planning levels (Hula & Udoh, 2015). The floods cause immediate issues with pollution, sanitation, unsafe housing, and other risks such as drowning, diseases and deaths caused by flooding/flood waters.

Urban flooding has been linked to pressures of increasing population in urban centres in countries like the US. UK and China (Hemmati, Ellingwood, & Mahmoud, 2020; Miller & Hutchins, 2017; O'Donnell & Thorne, 2020). Park and Lee (2019) indicate that the impact of urban land use on flood damages may increase in Korea if unplanned developments go on without the construction of appropriate infrastructure and facilities and stress the importance of land use planning measures to control flooding. In Ethiopia, flood adaptation measures has begun to be streamlined with urban planning in cognisance of the importance to integrate flood adaptation measures in planning processes (Worku, 2017). This was not the case in the past in Ethiopia due to lack of sufficient knowledge regarding the importance and ways to achieve this. In Benin-city Nigeria, urban planning has also been identified as a key driver of flooding in the city (Cirella, Iyalomhe, & Adekola, 2019).

The lack of proper urban planning and management is linked to the flooding problem in Port Harcourt (Elenwo & Efe, 2014; Ibama & Wocha, 2017). In Port Harcourt, increased urbanisation means a growing proportion of ground surfaces are concreted, which means there is no percolation of water, and inadequate drains to effectively clear the surface runoff (Adeloye & Rustum, 2011; Ede, Owei, & Akarolo, 2011). This makes it imperative to construct drainage systems to combat floods (Etuonovbe, 2011). The scale of the risk from flooding is heavily dependent on the quality of existing infrastructure. The research evidence linking urban planning to the flooding problem necessitates the view of planners who are directly engaged in planning functions to understand the shortcomings in the current system and the best ways to address them.

3 | THE URBAN PLANNING PROFESSION IN NIGERIA

Urban planning is a professional discipline belonging in the field of environmental studies and management (Aluko, 2011). Planners are, by legislation, involved in all levels of town planning activities and development. In Nigeria, the Town Planners Act 1988 regulates the practice of urban planning. In this Act, town planning refers to town and country planning for the purpose of improving the human environment. The Act established the Town planner's registration council for the registration of planners and comprehensively provides for the regulation of the town planning profession. It lays down the rules of who is an urban planner, functions of a planner, standards of knowledge expected and review of the standards as may be required in line with global practices (Omole & Akinbamijo, 2012). A registered town planner is entitled to practice in any state in Nigeria to the extent of their qualification.

4 | THE NATURE OF PLANNING IN NIGERIA AND PORT HARCOURT

The three tiers of government in Nigeria (federal, state, and local) are involved in urban planning in different capacities. (Figure 1 is a graphical illustration of the planning process in Nigeria) The planning law in all the states in Nigeria is the Nigerian Urban and Regional Planning Act (Decree 881992). This replaced the British colonial government's 1946 Town Planning Ordinance (Dung-Gwom, 2011). The federal level is tasked with roles such as: formulating national policies relating to urban and regional development and planning; devising and implementing the National Physical Development and Regional Plans; providing financial and technical assistance to states in devising and implementing plans; as well as promoting the training and education of planners. The state government is tasked with formulating its own state

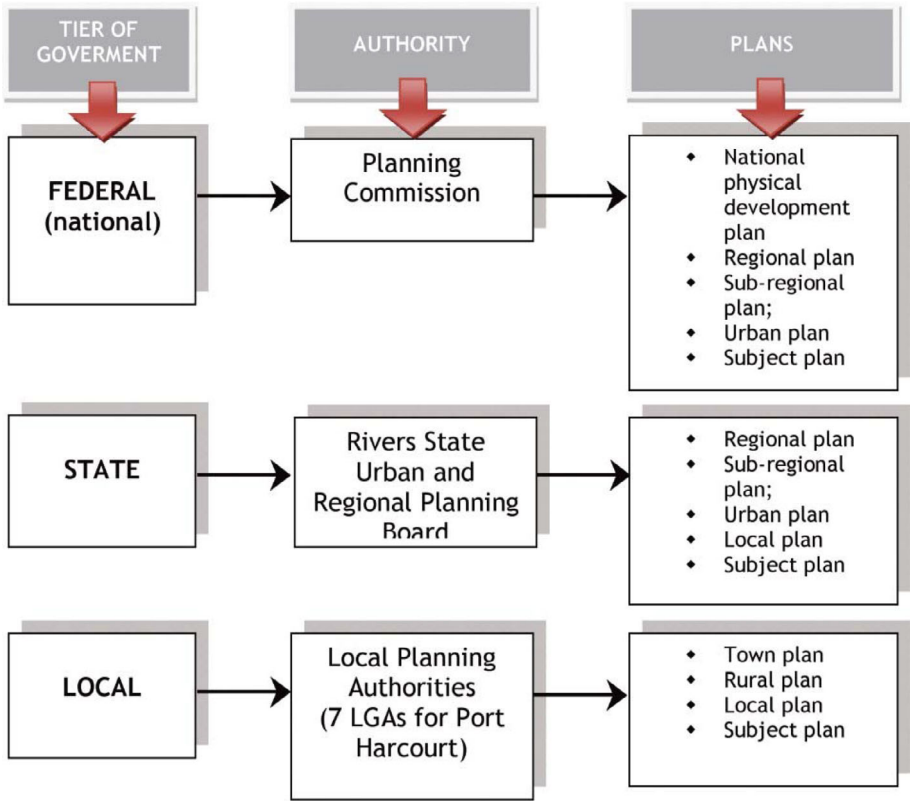

FIGURE 1 The planning system in Nigeria. *Source:* Greater Port Harcourt Master Plan, 2008

policy for planning within the stipulations of the national policy. The state also prepares and implements its regional, sub-regional, and urban plans as well as subject plans, and provides technical support and assistance to the local government in its implementation of local, rural, and subject plans. The local level is in charge of the town plan, rural plan, local plan, and subject plan.

5 | STUDY AREA

Port Harcourt is a coastal city in the heart of the Niger Delta area of Nigeria (see Figure 2). It is the capital of Rivers state which boasts Nigeria's largest oil and gas reserves making it a city of great economic importance (Orazulike et al., 2017). Port Harcourt is Nigeria's fourth largest city after Lagos (Southwest), and regional centres Kano (Northwest) and Ibadan (Southwest). Two million people reside in the rapidly expanding sprawl of Port Harcourt (Nlerum & Wechie, 2018). This represents an increase of around 600,000 people from the population recorded at the 2006 census. This big rise in population has naturally led to an increase in the number of urban dwellings of which the majority are unplanned and unregulated; this, in combination with high intensity rainfalls (Nwankwoala & Jibril, 2019), has been linked to the annual flooding of parts of the city (D Kio-Lawson & Dekor, 2014; Wizor, 2014).

Urban planning in Rivers state is regulated by the State Physical Planning Act of 2003 as well as the Greater Port-Harcourt City Development Authority (GPHCDA) Law No. 2 of 2009 (Ede et al., 2011). The urban development framework (UDF) is the strategic planning document/policy central to the GPHDCA planning policies. It guides the future development of the city according to the master plan. The current master plan was developed in 2008 and implemented in 2009. It adopts a holistic approach by recognising the essential role different areas contribute to planning. These areas include: (a) Town Planning Regulations /Land Use Management Schemes; (b) Designation of Planning Areas/Community Layout; (c) Land Acquisition / Compensation Policy and; (d) Development Control/Enforcement. The master plan has been commended as being comprehensive and incorporating the important factors that guide the development of the city (Ede et al., 2011). The master plan recognises the endemic flooding problem in the city and comprises a storm water master plan to manage flooding in the city.

6 | METHODOLOGY/METHODS

This work adopted a qualitative case study approach. In-depth face-to-face, semi-structured interviews were conducted with five qualified urban planners working in Port

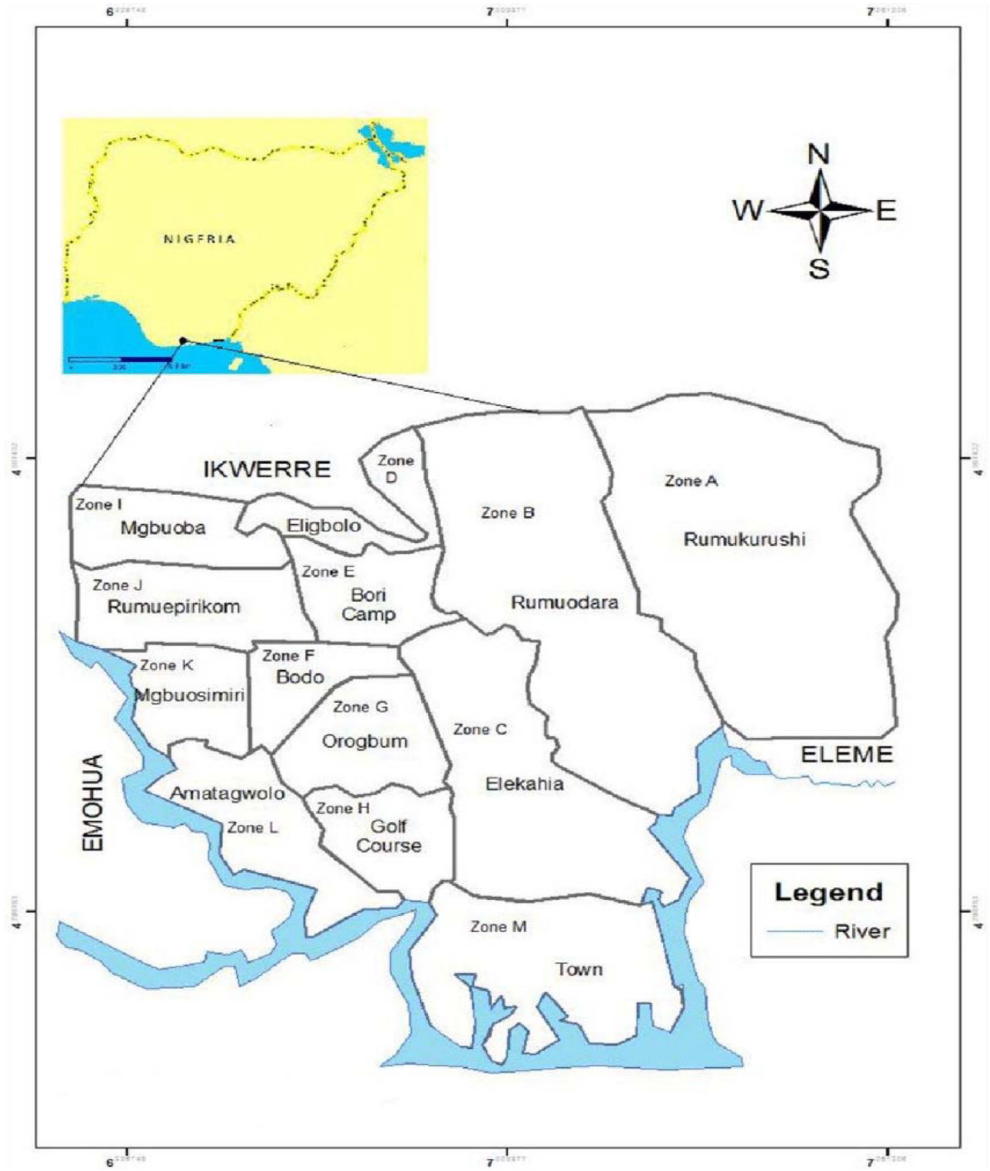

FIGURE 2 Map of Port Harcourt (Akukwe & Ogbodo, 2015)

Harcourt. The planners worked in various senior and mid-level roles in the city and all had over 10 years of experience. They were all male which reflects the male dominated nature of the town planning professions in Nigeria. They were recruited via snowballing whereby an urban planner acquaintance made the initial referrals. It is not uncommon for researchers to face hurdles in recruiting participants especially when the research topic is of a sensitive nature and involves the government in some capacity. This recruitment method was particularly ideal in the circumstance and helped in maintaining a cordial and trusting interview environment as they have been recruited via a person known to them. Interview questions centred on the flooding in the city and its causes; the relationship between planning and the flooding; what planners should prioritise to control the flooding/possible control measures; the best ways to tackle the flooding problem; and the impact of flooding on the residents and the wider environment. The interviews were recorded and transcribed verbatim and coded to elicit meaning and themes. The respondents were given pseudonyms to protect their identity (See Table 1). This was important because 80% of them were still in active government service.

7 | EFFECTS OF POOR URBAN PLANNING IN PORT HARCOURT

The planners identified different aspects of poor urban planning in the city as the main precursors of the perennial flooding. These are discussed under the subheadings:

TABLE 1 Overview of research participants

S/N	Name	Age	Gender	Sector employed	Career level
1	Priye	55	Male	Government	Senior level career civil servant
2	Tamuno	57	Male	Government	Senior level academic and planning consultant
3	Barry	40	Male	Government	Mid-level career civil servant
4	Ovunda	45	Male	Government	Mid-level career civil servant
5	Paul	38	Male	Private	Mid-level private practice professional(architect)

urbanisation, rise in informal settlements and noncompliance; displacements and service disruptions; psychological and economic impacts and; health impact.

7.1 | Urbanisation, rise in informal settlements and noncompliance

There is a housing construction boom in Port Harcourt fuelled by urbanisation and population growth. The agricultural lands surrounding Port Harcourt are being increasingly converted to residential areas to accommodate housing needs. This urban development is being carried out without proper controls in place, worsening the flooding problem (Dan-Jumbo, Metzger, & Clark, 2018). Urban planning in Nigeria is compounded by a failure to ensure new developments comply with urban planning regulations.

Priye, a senior level government planning professional with the GPHCDA commented:

> There is high correlation [between planning and flooding] because most of the areas that are experiencing this deep-seated flooding are not planned. If we look at it [the flooding problem] from the holistic approach, it is urbanization. Our land use management is also a problem where people are building on floodplains. The flooding of 2012 and the one that happened recently we were able to trace points that they have blocked this natural drain.

Another participant, Ovunda, a surveyor with the GPHCDA also highlighted the issue of constructions on waterways as a planning failure stating:

> Carrying out indiscriminate erection of buildings, some of these buildings are built on the natural waterways, on the natural canals and not regulating or maintaining the open spaces.

As both Priye and Ovunda observe, lax enforcement of planning laws has seen construction projects spring up on natural floodplains and on storm water paths. This obstructs the free flow of water which leads to flooding as there is no escape path for the water. Flood waters and stagnant flood waters weaken building structures (Chendo & Obi, 2015; Dube, Mtapuri, & Matunhu, 2018) promoting the collapse of buildings which is common in Nigeria (Olukanni, Adebayo, & Tenebe, 2014). Flood waters standing for long periods on asphalted roads also destroy the asphalt cover, impacting the already weak infrastructure of Nigerian cities (Aliyu & Amadu, 2017).

Barry, a local government planner also noted:

> People are neglecting the principles of development and sustainability by building on the waterways where they are not supposed to. There is a channel for water to move and it is the people that own the community, because of money or whatever, who sold the place to individuals and they [developers] develop and block the waterways. In addition, when there is rainfall there is no way water will leave the place, it will turn to flood and we are suffering. A case study is Port Harcourt here, in many places. So, the people are not following the development [plan] of the city.

Barry's view that the government needs to ensure that development plans are adhered to in order to address the issue of flooding in Port Harcourt could be rooted in his first-hand experiences of nonadherence to the master plan by virtue of his job as a council planner. It is clear to him that the constructions springing up every day do not align with the master plan. Barry strongly believes it is of great importance to comply with the master plan, a sentiment reinforced by his other statements throughout the interview. The disregard of the master plan and planning policies suggests a lack of political will by the government to enforce regulations.

The research participants also highlighted the disregard for development plans by developers.

Paul, an architect in private practice noted:

> You also have the people who are developing, the developers ... who don't follow the building, respect the codes you know, ... they cover the drainage system so and of course if you build over and across the drainage system, you are blocking the natural waterway.

Paul infers that people willingly and consciously commit such infractions. One possible reason for this is they know that the planning laws are not being enforced. If there were real consequences, like fines and punishments for the actions of the defaulters, the situation might be different as people are more inclined to change their attitudes faster when there is a price to be paid (Bar-Ilan & Sacerdote, 2004). Britain Tidy (2011) supports this view, arguing that people are more likely to change their behaviour either when punishment is seen as a real threat, or when people have been punished or know someone who has been punished themselves. The construction of buildings on floodplains and on areas that block storm water paths raises important questions regarding what procedures, if any, were followed in granting planning approvals for these development projects because some of these constructions have approvals. It also raises questions regarding whether such building approvals were influenced by bribery, which has become a widely accepted practice in Nigeria (Hope, 2017; UNODC, 2017).

Corruption is indeed a plague that cuts across different public and public sectors in Nigeria (Agbiboa, 2013). It is also evident in the planning sector in Port Harcourt where corrupt practices and bribery have facilitated the change of the city's landscape against the dictates of the master plan and laid down planning rules and regulation. It is not uncommon for town planning officials to accept bribes and overlook issues—these may include the unauthorised use of land, the alteration of approved construction plans and building in areas that obstruct drains and natural waterways (Oladokun & Proverbs, 2016).

In Port Harcourt, increasing demand for housing due to urbanisation has increased land and housing prices beyond the reach of the poor who are forced to the less desirable and more disadvantaged areas (Kio-Lawson, 2014). They must have a place to live as shelter is a basic need. Some of the people impacted relocate to cheaper areas, such as waterside[1] settlements, and build whatever form of structure they can afford. There is minimal infrastructure in these settlements, such as basic sanitary facilities, and faecal matter is carried out in the open sea waters (Obafemi & Odubo, 2013). The waterside settlements of Port Harcourt have a resident population of over 500,000 (Kio-Lawson, 2014). Given the dense population in these settlements, flooding episodes cause a lot of damage and misery.

Proper planning would have ensured that there is no settlement in these areas, or that the development of these areas was to standards that afford basic sanitation levels, for instance, availability of sewerage systems. Tamuno, a senior level academic and planning consultant highlights this rise in informal settlements due to increases in land prices from urbanisation and the attendant impact:

> Urbanisation is so high and that is why you see a lot of informal settlements. The land value is high to the extent that the poor are denied access to the land and when that does happen they move to the fringe and that is why you see most of them will stay in a wet area because it is not expensive.

Informal settlements are a problem the state government is seeking to curb but the flooding has only served to displace residents and push them further into squatter settlements. This highlights the multi-faceted nature of the effects of flooding in the city.

7.2 | Displacements and service disruptions

The impact of flooding is inimical to development. This is because it affects all three bottom lines (social, economic and environmental) of sustainable development (Onifade, Adio-Moses, Adigun, Oguntunji, & Ogungboye, 2014; Reckien et al., 2017). Paul also elaborated on displacements caused by flooding:

> It [flooding] has a lot of impact which you and I know. One, it will make you a Refugee, it will displace you. If you are a farmer it is going to destroy your farm and when something touches your economic backbone, are you a living being at all? It causes death and sickness most of the flood that came in 2012, the level of the water stays for about six months.

Reports of wild animals and dangerous reptiles invading people's homes during flooding is quite common (Akasike, 2017). Ovunda notes:

> When the place is flooded people will be exposed to different dangers. The flood will go up to the thick bushes and forests. Wild animals, reptiles, snakes will all come to the places of the highland and the highland area is where people live so they will be looking for where to perch on.

Priye adds:

> Snakes, wild animals were going into people's house biting people and some other things. It [flooding] influences the utility [infrastructure] even within the town, too much percolation will kill the road, the road will go. If power is constant some people will be electrocuted, more buildings will collapse, there will be pressure in the health system. The money they will use to develop some other areas will go for health. Government will be disrupted so it has many impacts.

Priye also describes the impact of floods on physical infrastructure and organisational infrastructure such as the smooth functioning of the government or the delivery of essential health services. Running the government is impacted as workers cannot go to work if their offices are overtaken by floods, as was the case when the Federal Roads Safety Commission Office in Port Harcourt was flooded in 2017 (See Figure 3). In many cases, the flood waters are so high that economic activities are shut down because people cannot leave their homes without risk of drowning (Ikechukwu, 2015).

Port Harcourt is predominantly Christian, and churches form a central aspect of the residents' lives.

FIGURE 3 Flooded Federal Road Safety Commission Premises Port Harcourt. *Source:* Vanguard Newspaper July 24, 2017

Elaborating further on the social impact of flooding, Priye related the pain of churchgoers who were displaced from their place of worship by the floods:

> Even the social system and the traditional system will be destroyed. Those that believe in shrine worshiping and some other things, if your shrine is flooded, you are disconnected. Also in a religious body, if your church, which is the larger assembly point, is occupied, such as Winners[2] [a church], if you are coming now you will see the place they have not been worshiping there for almost one year now. They have not been worshipping there [Winners'] — you know the pain of relocating from an area where you are used to communing with God. You are now spending more money [transportation costs to alternative places of worship], so these are the problems.

The flooding indeed impacts social life in different ways as has been highlighted in the above excerpts.

7.3 | Psychological and economic impacts

Flooding takes a huge psychological and economic toll on the people and impacts the environment. In developing societies, the poor end up being the most impacted (Yamin, 2014). For instance, when the consequences of building on the flood plains manifest in flooding, the poor have no recovery buffer or safety net, unlike those who are better off financially. Tamuno describes the financial, psychological, and economic impact of flooding:

> Well, the residents living within an environment, and you know whatever you buy, you think that, ok, the next twenty years I will not be buying a mattress again, but the flood can make you now to start looking for money. Your certificates are compromised, your household things, your life because we have had situations where electrocution had taken place from the flood. So, it has a huge financial, psychological, mental burden on the people affected by the flood. In terms of environment ... if it is where you have cropping, it also could destroy the crops.

Tamuno notes that the economic burden of flooding includes the destruction of properties as well as means of

livelihood. Paul, who also had a farm, shared his own personal experience of the floods, highlighting the economic and psychological impact the flooding had on him and those around him:

> I had a personal experience ... I had a poultry farm and a fish farm, so when we had that flooding that happened in 2006 and 2007, the flood entered my farm. I lost so many birds then even the fish ponds were filled up, you know, overflown with water, the fishes came out in the compound, in the premises, in the drainage we were seeing the fishes. I lost so many fishes. I had to sell the birds just so that I do not have a total loss, so I had to just sell at giveaway prices. I could not even sell all so I had to take some to the cold room so yea, I had a lot of loss, so the effects or impact of this flooding is really negative. I know of one man that is close to the site where we were developing, last year, they moved out of their house because the whole place was covered with flood, you know, after a while, this time when the flood went down, they returned back and as it happened this year again, he packed again. Somebody is sheltering them, so it is negative. A lot of properties in the house, people lose their property, people lose electronics, in most cases, children get drowned especially when their parents are not home. Impact of the flooding is really negative.

The economic impact of flooding is evident and has been widely reported in academic research. The agricultural and small business sectors are worst hit, and the annual nature of the disaster portends more doom if concrete action is not taken. The economic impact of flooding is more dire in developing countries like Nigeria as the resources to build back are not readily available. This takes the country further off the path to development.

7.4 | Health impact

Flooding has associated health impacts and has also led to deaths (Ikechukwu, 2015; Oriji, 2015). Ovunda describes the impact of flooding on the health of those affected:

> Flooding exposes people to epidemics like cholera. The sewage system will be polluted, such that even at some point, the underground water will also be polluted.

Ovunda notes that some of these worst hit places are already in disadvantaged areas supporting Tari, Brown, and Chikagbum (2015). Barry's comment highlights the health impacts of flooding:

> It is a big problem. In short, it is really bad. It dislodges the residents making them not to have homes again. Sickness all over, some of them as a result of that, they could not survive. They died as a result of flooding. So, it has a very big impact.

Infectious disease outbreaks are widespread because of the pollution problems that go hand in hand with flooding. According to WHO (2012), immediate health risks posed by the 2012 flooding in Nigeria included an outbreak of foodborne and waterborne diseases; displacements resulting in overcrowding in temporary shelters which promotes the spread of transmissible diseases like measles; and medium term risks of malaria and yellow fever as a result of proliferation of vector breeding grounds. There was also limited access to health services as a result of the destruction or overwhelming of the health infrastructure, damage of drugs and supplies and displacement of health-care workers themselves, and transmission of communicable diseases and malnutrition which weakens immunity, and leads to more frequent bouts of infections. These health risks remain present during every flooding disaster. The inability of hospitals to deliver important services when they are flooded leads to higher mortalities from secondary causes during flooding events (Menne, Brown, & Muray, 2014).

The health impact of flooding on residents of mostly indigent neighbourhoods has been widely explored in research. Olanrewaju, Chitakira, Olanrewaju, and Louw (2019) found that as many as 47.1% of residents of an indigent Nigerian community suffered Cholera and dysentery due to breakdown of sewerage systems and subsequent contamination of water and food during flooding. Malaria, skin diseases, and other water-borne diseases were rife during and after flooding episodes. In 2018 in Rivers State, there was an outbreak of skin diseases in some communities which had no choice but to bathe, drink and cook with the contaminated flood waters (Iheamnachor, 2018). The health impacts of flooding are multiplex and also manifests in longer-term mental-health issues.

FIGURE 4 A section of a drain filled with rubbish in February 2019 (Source: Author)

8 | FLOODING AND WASTE MANAGEMENT IN PORT HARCOURT

The poor attitude of Nigerians to waste disposal has been widely discussed in various studies (Eneji, Eneji, Ngoka, & Abang, 2016; Ojo & Adejugbagbe, 2017; Olukanni et al., 2014; Sridhar & Ojediran, 1983). Drainage blockages linked to poor sanitation practices is common in Nigeria's highly populated urban areas like Port Harcourt. Roadside dumping, canal dumping, and dumping in rains is commonly practiced among a large proportion of the population (Figure 4). This causes blockage and results in flooding during the rainy season. Even though the master plan incorporates waste management (Ede et al., 2011), it could be said to exist only on paper as a result of poor implementation. Planners have a role in the siting of waste management facilities during the design and development of a city (Onu, Surendran, & Price, 2014). However, in Rivers state, they are not involved in the day to day management of waste as there is a separate and independent waste management authority. In Paul and Ovunda's view, the poor attitude of the residents, which they saw as bordering on ignorance and lack of awareness about waste management, contributes to the flooding. Paul comments that a poor waste management attitude means the people see the rains as a time to dispose of rubbish in the drains. He states:

> Of course, you also have the refuse disposal mentality of the people, poor mentality of the people towards refuse disposal, you know. In Port Harcourt, if it starts raining, people bring their refuse and start throwing into the canal or the waterway, you know, all of them gets stuck somewhere like a bottleneck, and then returns the water back to the place.

Paul's comment describes lack of knowledge by the people on what happens to the rubbish carried off by the water, which piles up at a place and obstructs the flow of water and contributes to the flooding. Ovunda also shared Paul's view that a lack of understanding of effective solid waste management also contributes to the problem of flooding. He said:

> Some of the factors are human activities, human factors lack of environmental (awareness), and lack of proper management of solid waste.

Indeed, roadside rubbish, and drains covered in rubbish are not an uncommon sight in Port Harcourt city.

9 | ADDRESSING THE FLOODING: URBAN PLANNERS' PERSPECTIVES

Despite the planners' concerns and disappointment with the lack of compliance with planning laws and the widespread practice of dumping by the population that contribute to the attendant flooding being experienced in Port Harcourt, they had a positive outlook for the future. They proffered a range of suggestions on how the current situation could be improved to control the flooding. These included collaboration among all stakeholders, cooperative implementation of existing planning laws and policies and improved infrastructure as detailed below.

9.1 | Collaboration among all the stakeholders and cooperative implementation of the existing planning laws and policies

Collaboration was strongly called for, and the planners saw themselves as having an important role to play. Tamuno remarked:

> It is to work with the communities and government, especially in the new directions,[3] the new growth directions, to put in place proper land settlement [community land settlement] so that, we will not increase the problem ... For example, if there are

> drainages and the drainages are well connected, at least after some minutes (if it rains), it can get the flood away. So, we need to really do a proper drainage master plan. We need to do an infrastructure master plan with the government backing and the community people so that we look at this thing, and perhaps even do some simulations, because what they see, they appreciate more. "Look if you do this and there is flooding and all those things, well ...", so we do the simulations so that the community and landowners will see that this thing is real. "If we don't take this measure this is what will happen". So the new areas by the time we start the work and simulate, they will know what has happened to other people and then, they can say "ok, let us key into this vision".

Tamuno believes that government planners have an important role in community education on flooding. Paul also emphasised education of the residents and its important role and relevance to urban planning policy and law. He opined that the government planners have to engage in more field work and carry out layouts of developing areas. He stated:

> Planners need to go into the developing areas, let the people know where we have natural waterways so that they know and don't go beyond, and build over these waterways; map out, let people know where they are supposed to develop, where they are supposed to build and where they are not supposed to build. They also need to do some form of campaign or enlightenment campaign or sensitizing the people, poor attitude towards refuse disposal, like I said, when it starts raining, people bring their refuse and dump inside the canal or the waterways.

Paul also shared a story of how a high-ranking government personality built a house over a key canal and caused flooding which impacted the residents for many years until the government of the day demolished this illegal structure. He commended the government for their actions at the time and also explained how they expanded the canal which enabled better flow of storm water and solved the flooding problem in that neighbourhood. Paul's example shows that decisive action by the government is needed to tackle the flooding menace. Similarly, Priye also believed that planners have a role to play. He stated:

> What the urban planners can do to control the flooding is that one, the urban planners should collaborate with the government so that all the policy documents that concerns planning should be implemented because government cannot put law and ignore and deviate from the law they have put in place, and planners should engage more on advocacy.

9.2 | Improved infrastructure

Barry emphasised the need for drainages as an integral part of every building construction which must be linked to appropriate channels and called for underground drainage as a better solution to the surface drainages which are more common in Nigeria. He believes that underground drainages are the best solution for the local situation where residents are prone to dispose of rubbish in open drains. For Ovunda:

> The most important things that can be done by urban planners to control the flooding is first of all to remove, clear the existing canals and drains, and establish new canals that will carry water, runoff water from the surface down to ocean.

Ovunda's suggestion would help alleviate the flooding problem as it has been shown that there is poor infrastructure in the city and a need for sustainable and properly channelled drains. Indeed the government has failed to provide basic infrastructure like storm water channels for the people (Adeloye & Rustum, 2011) which has made the rainy seasons akin to a nightmare for city residents. Paul also accentuated that clearing drains and improving infrastructure solved the flooding problem which also plagued his suburb for many years.

10 | CONCLUSION

This paper has demonstrated how poor implementation and compliance with urban planning regulations are major factors in the flooding problem in Port Harcourt city, Nigeria. The study finds that the problem is not due to the absence of planning strategies, adequate plans or guidelines but rather, implementation and enforcement of regulations. The respondents established a causative link of planning to the flooding menace and believe that better planning can solve the

flooding problem in the city. Areas of improvement advocated by the planners include provision of infrastructure, implementation of the planning laws and cooperation among the planners in various agencies as well as involvement of residents in planning and education and improvement of waste management. There is an urgent need for the planning system to be overhauled to change the status quo. This can be achieved by the government having the will to implement the dictates of the master plan which ought to guide the development of the city as was intended. Contravening constructions on floodplains need to be removed to help alleviate the flooding. Better planning can be achieved by effective collaboration with all stakeholders including the community. Urban planners need to be given full support by the government in carrying out their functions and bad eggs who contribute to the problem by approving and allowing indiscriminate constructions need to be sanctioned. Integration of flood control as a core aspect of planning will also help in controlling flooding. While this study was conducted in one city, findings may be relevant in other Nigerian cities that experience flooding. The view of the planners in this research who are at the coalface of planning supporting the link between urban flooding and planning implies that more attention needs to be paid to flood mitigation in the urban planning process. The findings support the rising call for urban design to forecast and plan for flooding. This is also important for other countries rapidly urbanising and experiencing increased flooding events. This research provides evidence to countries who have not yet recognised the importance of integrating flood management in urban planning. Such countries are encouraged to consider available evidence from elsewhere which supports this need. It is critical that integrated flood risk management strategies form an essential aspect of urban development and planning given the increasing flood occurrences globally. To build more resilient cities, the urban planning system need to be more robust, acknowledge the possibility of disasters, plan for it, and implement the plans. Indeed, urban planning cannot be separated from flooding events despite the presence of other contributory factors.

ENDNOTES

[1] Waterside settlements refer to informal settlements on reclaimed land along the several creeks and waters surrounding Port Harcourt city. These settlements developed over the years without any formal participation, approval or interest by government. The settlements are known for lacking basic amenities and infrastructure. A lack of adequate sanitation poses severe environmental and health concerns which is exacerbated by flooding.

[2] Winners church is a big Pentecostal church in Nigeria. Priye is talking about one of the branches he passes by on his way to work daily that was overtaken by floods in 2018.

[3] By new directions Tamuno means the new developing areas of Port Harcourt city

DATA AVAILABILITY STATEMENT

Interview transcripts can be obtained by contacting the author.

ORCID

Adaku Jane Echendu https://orcid.org/0000-0003-3697-1274

REFERENCES

Adeloye, A. J., & Rustum, R. (2011). Lagos (Nigeria) flooding and influence of urban planning. *Proceedings of the Institution of Civil Engineers-Urban Design and Planning*, *164*(3), 175–187.

Agbiboa, D. E. (2013). Corruption and economic crime in Nigeria: Social and economic perspectives. *African Security Review*, *22*(1), 47–66.

Akasike, C. (2017). Snakes took over our houses during the flood –Rivers residents. Retrieved from https://punchng.com/snakes-took-over-our-houses-during-the-flood-rivers-residents/

Akukwe, T. I., & Ogbodo, C. (2015). Spatial analysis of vulnerability to flooding in Port Harcourt metropolis, Nigeria. *SAGE Open*, *5*(1), 2158244015575558.

Aliyu, A. A., & Amadu, L. (2017). Urbanization, cities, and health: The challenges to Nigeria–a review. *Annals of African Medicine*, *16*(4), 149–158.

Aluko, O. E. (2011). Urbanization and effective town planning in Nigeria. *African Research Review*, *5*(2), 126–139.

Bar-Ilan, A., & Sacerdote, B. (2004). The response of criminals and noncriminals to fines. *The Journal of Law and Economics*, *47*(1), 1–17.

Britain, T. K. (2011). *The Effectiveness of Enforcement on Behaviour Change*. UK: Wigan. https://www.ipsos.com/sites/default/files/publication/1970-01/sri-manchester-effectivness-of-enforcement-kbt-2011.pdf.

Chendo, I., & Obi, N. (2015). Building collapse in Nigeria: The causes, effects, consequences and remedies. *International Journal of Civil Engineering, Construction and Estate Management*, *3*(4), 41–49.

Cirella, G., & Iyalomhe, F. (2018). Flooding conceptual review: Sustainability-focalized best practices in Nigeria. *Applied Sciences*, *8*(9), 1558.

Cirella, G. T., Iyalomhe, F. O., & Adekola, P. O. (2019). Determinants of flooding and strategies for mitigation: Two-year case study of Benin city. *Geosciences*, *9*(3), 136.

Dabi, M., & Kporha, M. A. (2015). Unsustainable development, climate change and floods: Interactions and impacts. *The International Journal of Science and Technoledge*, *3*(6), 278.

Dan-Jumbo, N., Metzger, M., & Clark, A. (2018). Urban land-use dynamics in The Niger Delta: The case of greater Port Harcourt watershed. *Urban Science*, *2*(4), 108.

Doocy, S., Daniels, A., Murray, S., & Kirsch, T. D. (2013). The human impact of floods: A historical review of events 1980-2009 and systematic literature review. *PLoS Currents*, *5*. https://dx.doi.org/10.1371/currents.dis.f4deb457904936b07c09daa98ee8171a.

Dube, E., Mtapuri, O., & Matunhu, J. (2018). Managing flood disasters on the built environment in the rural communities of Zimbabwe: Lessons learnt. *Jàmbá: Journal of Disaster Risk Studies*, *10*(1), 1–11.

Ede, P. N., Owei, O. B., & Akarolo, C. I. (2011). Does the greater Port Harcourt master plan 2008 meet aspirations for Liveable City. In *Paper presented at the ISOCARP congress 2011 Liveable cities-Urbanising world*. Meeting the: Challenge.

Elenwo, E. I., & Efe, S. I. (2014). Flood problems in Port Harcourt Metropolis, Nigeria. *International Journal of Environmental Engineering and Natural Resources*, *1*(2), 97–107.

Eneji, C.-V. O., Eneji, J. E. O., Ngoka, V., & Abang, M. (2016). Attitude towards waste management and disposal methods and the health status of Cross River state, Nigeria. *SCIREA Journal of Agriculture*, *1*(2), 231–247.

Etuonovbe, A. K. (2011). The devastating effect of flooding in Nigeria. Paper presented at the FIG working week.

Hemmati, M., Ellingwood, B. R., & Mahmoud, H. N. (2020). The role of urban growth in resilience of communities under flood risk. *Earth's Future*, *8*(3), e2019EF001382.

Hope, K. R. (2017). Corruption in Nigeria. In *Corruption and governance in Africa* (pp. 125–162). London, UK: Palgrave Macmillan.

Hula, M., & Udoh, J. (2015). An assessment of the impact of flood events in Makurdi, Nigeria. *Civil and Environmental Research*, *7*(10), 53–60.

Ibama, B., & Wocha, C. (2017). Urban growth: Challenges, management and planning implication in Port Harcourt municipality. *Journal of Global Ecology and Environment*, *6*(4), 135–148.

Iheamnachor, D. (2018). Agonies of Rivers flood victims. Retrieved from: https://www.vanguardngr.com/2018/10/agonies-of-rivers-flood-victims/

Ikechukwu, E. E. (2015). Socio-economic impacts of flooding on the residents of Port Harcourt Metropolis in Rivers state, Nigeria. *Natural Resources*, *6*(01), 1–8.

Israel, A. O. (2017). Nature, the built environment and perennial flooding in Lagos, Nigeria: The 2012 flood as a case study. *Urban Climate*, *21*, 218–231.

John, D. G. (2011). Urban and Regional Planning in Nigeria 1999 to 2011. https://dx.doi.org/10.13140/RG.2.1.2472.3441.

Kio-Lawson, D. (2014). The squatters of Port Harcourt, Nigeria: Their identity, wants, characteristics and policy options. *International Institute for Science, Technology and Education*, *4*(22), 40–49.

Kio-Lawson, D., & Dekor, J. (2014). Port Harcourt, the Garden City: A garden of residents nightmare. *World Environment*, *4*(3), 111–120.

Menne, B., Brown, L., & Muray, V. (2014). Floods and health, fact sheets for health professionals. World Health Organization, Regional Office for Europe, *1*.

Miller, J. D., & Hutchins, M. (2017). The impacts of urbanisation and climate change on urban flooding and urban water quality: A review of the evidence concerning the United Kingdom. *Journal of Hydrology: Regional Studies*, *12*, 345–362.

Nkwunonwo, U., Malcolm, W., & Brian, B. (2015). Flooding and flood risk reduction in Nigeria: Cardinal gaps. *Journal of Geography & Natural Disasters*, *5*, 136.

Nkwunonwo, U., Whitworth, M., & Baily, B. (2016). A review and critical analysis of the efforts towards urban flood risk management in the Lagos region of Nigeria. *Natural Hazards and Earth System Sciences*, *16*(2), 349–369.

Nlerum, F., & Wechie, E. (2018). Greater Port Harcourt City urbanization project and its socio-economic effect on affected farming communities in Rivers state. *Journal of Sociological Research*, *9*(1), 91–101.

Nwankwoala, H., & Jibril, T. (2019). Flood height measurement and analysis in parts of Obio/Akpor local government area, Port Harcourt Metropolis, Nigeria. *Engineering Management Research*, *8*(2), 1–10.

Obafemi, A. A., & Odubo, T. V. (2013). Waterfronts redevelopments in Port Harcourt Metropolis: Issues and socio-economic implications for urban environmental management. *International Journal of Engineering Science*, *2*, 1–14.

O'Donnell, E. C., & Thorne, C. R. (2020). Drivers of future urban flood risk. *Philosophical Transactions of the Royal Society A*, *378*(2168), 20190216.

Ojo, O. O., & Adejugbagbe, J. A. (2017). Solid waste disposal attitude in Sango Ota, Ogun state: Implication for sustainable city development in Nigeria. *Journal of Environment and Waste Management*, *4*(3), 253–260.

Oladokun, V., & Proverbs, D. (2016). Flood risk management in Nigeria: A review of the challenges and opportunities. *Flood Risk Management and Response*, *6*(3), 485–497.

Olanrewaju, C. C., Chitakira, M., Olanrewaju, O. A., & Louw, E. (2019). Impacts of flood disasters in Nigeria: A critical evaluation of health implications and management. *Jàmbá: Journal of Disaster Risk Studies*, *11*(1), 1–9.

Ologunorisa, T. E., & Adeyemo, A. (2005). Public perception of flood hazard in The Niger Delta, Nigeria. *Environmentalist*, *25*(1), 39–45.

Olukanni, D. O., Adebayo, R. A., & Tenebe, I. T. (2014). Assessment of urban drainage and sanitation challenges in Nigeria. *International Journal of Emerging Technology and Advanced Engineering*, *4*(12), 100–105.

Omole, F. K., & Akinbamijo, O. B. (2012). Land development and planning laws in Nigeria: The historical account. *JL Pol'y & Globalization*, *8*, 25.

Onifade, O., Adio-Moses, R., Adigun, J., Oguntunji, I., & Ogungboye, R. (2014). Impacts of flood disaster on sustainable National Development in Ibadan north local government, Oyo state. *Oman Chapter of Arabian Journal of Business and. Management Review*, *34*(2597), 1–9.

Onu, B., Surendran, S. S., & Price, T. (2014). Impact of inadequate urban planning on municipal solid waste management in The Niger Delta region of Nigeria. *Journal of Sustainable Development*, *7*(6), 27.

Orazulike, N. C., Justina, J. O., Christopher, C. C., Tamunomie, K. N., & Samuel, A. U. (2017). A 3-year retrospective review of mortality in women of reproductive age in a tertiary health facility in Port Harcourt, Nigeria. *International journal of women's health*, *9*, 769–775. https://dx.doi.org/10.2147/IJWH.S138052.

Oriji, C. C. (2015). What to do about climate change-caused flooding and the associated diseases in Rivers state of Nigeria. *Global Journal of Human-Social Science Research*, *15*(4), 29–33.

Park, K., & Lee, M.-H. (2019). The development and application of the urban flood risk assessment model for reflecting upon urban planning elements. *Water*, *11*(5), 920.

Reckien, D., Creutzig, F., Fernandez, B., Lwasa, S., Tovar-Restrepo, M., McEvoy, D., & Satterthwaite, D. (2017). Climate change, equity and the sustainable development goals: An urban perspective. *Environment and Urbanization*, *29*(1), 159–182.

Sridhar, M., & Ojediran, O. (1983). The problems and prospects of refuse disposal in Ibadan City, Nigeria. *Journal of Environmental Health*, *46*(1), 28–31.

Tari, E., Brown, I., & Chikagbum, W. (2015). Climate change, disaster risk management and the urban poor in Port Harcourt Metropolis. *International Journal of Scientific & Technology Research*, *4*(5), 58–65.

UNODC. (2017). Corruption in Nigeria,bribery: public experience and response. Retrieved fromhttps://www.unodc.org/documents/data-and-analysis/Crime-statistics/Nigeria/Corruption_Nigeria_2017_07_31_web.pdf

WHO. (2012). Public Health Risk Assessment and Interventions. *Flooding disaster: Nigeria*. Retrieved from https://www.who.int/hac/crises/nga/RA_Nigeria_1Nov2012a.pdf

Wizor, C. H. (2014). Residential development dynamics in Port Harcourt Metropolis: Implication for efficient urban planning. *Journal of Environment and Earth Science*, *4*(6), 78–85.

Worku, H. (2017). Integrating climate change adaptation strategies in urban planning and landscape design of Addis Ababa City, Ethiopia: Using urban planning and landscape design to mitigate flooding, drought, and urban heat Island effects. *Environmental Quality Management*, *27*(1), 5–21.

Yamin, A. (2014). *Why are the poor the most vulnerable to climatic hazards (floods)? A Case Study of Pakistan, Term paper*, (pp. 1–19). Germany: University of Potsdam.

How to cite this article: Echendu AJ. Relationship between urban planning and flooding in Port Harcourt city, Nigeria; insights from planning professionals. *J Flood Risk Management*. 2021;1–13. https://doi.org/10.1111/jfr3.12693